REMARKS/ARGUMENTS

The Applicants hereby request reconsideration of the rejected claims.

The Specification has been amended to delete a reference to a patent application that is no longer pending. Claim 1 has been amended. New claims 21-28 have been added. No new matter has been added by the amendment or by the new claims.

Recitation of the Invention as-claimed:

One aspect of the invention, as recited in amended claim 1, is a bistable structure. The bistable structure is provided with a deflection element that includes mechanically constrained end points and a compliant span between the end points that is substantially free to deflect between two stable positions when a force is applied at a point along the span. The deflection element span is provided, as-fabricated, curved in one of the two stable positions. The curve of the deflection element span includes a curve maxima at a point along the span length that is at least about ¼ of the span length from the end points of the span. Further, the deflection element span is characterized by a thickness that is modulated along the span. The deflection element span is configured to substantially prohibit development of a second bending mode that is characteristic for the span as the element deflects between the two stable positions.

Rejections of the Claims:

Claims 1-8, 11-13, 15, and 18 were rejected under 35 U.S.C. §102(a) as being anticipated by Figs. 1A, 1B, 2A, and 2B of the instant application, identified as prior art.

Referring to ¶[05] and ¶[06] of the instant application, it is explained that in Fig. 1A there is shown a single suspended beam 10 in an initial, un-actuated, uncurved condition. Fig. 1B shows the beam of Fig. 1A when actuated to become curved into stable positions 11a, 11c, and when actuated to become curved into an unstable position 11b. Similarly Fig. 2A shows a double beam 20 in an initial condition that is of an initially straight, uncurved geometry. Fig. 2B shows the double beam when curved into two stable positions 21a, and 21c, and when curved into an unstable position 21b.

The claims require that the span of a deflection element of a bistable structure be provided in an initial, as-fabricated, position that is curved, and that is curved in one of the two stable positions of deflection. As shown in Figs. 1A and 2A, the prior art beams are in contrast uncurved in their initial, un-actuated position. The prior art beams are not initially, as-fabricated, curved in one of two stable positions - the curved stable positions shown in Figs. 1B and 2B are different from the straight, uncurved position of Figs. 1A and 2A and can only be achieved by forcing the beams into those positions. As explained in the Background section, the use of mechanical stress in design of these beams requires the initial straight configuration. This is in complete contradiction with the initially-curved-deflection element requirement of the claims.

The claims further require that the as-fabricated curve of the structure span include a curve maxima at a point along the length of the span that is at least about ¼ of the span length from the end points of the span. But the prior

art beams of Figs. 1A and 2A exhibit absolutely no curve as-fabricated, let alone providing the curve maxima location required by the claims.

The claims further require that the deflection element be characterized by a thickness that is modulated lengthwise along the span of the element. Examples of this thickness modulation are illustrated in Figs. 10A, 10B, and 25 of the instant application and described in detail at paragraphs ¶[96] to ¶[103] of the instant application. A MATLAB code module for carrying out an analysis to produce this thickness modulation is given in Appendix B of the instant application. The resulting thickness modulation is imposed on the curve of the span, as shown specifically in Figs. 10A-10B; in other words, the span is curved in its initial position and along the curve, the thickness of the span is modulated. But the prior art beams of Figs. 1A and 2A are completely uniform in thickness across the entire extent of the beams; there is no modulation of beam thickness as required by the claims, and as explained above, the beams are uncurved in their initial positions.

The Applicants therefore respectfully submit that the prior art beams shown in Figs. 1A, 1B, 2A, and 2B do not teach or even suggest the bistable deflection element of the invention.

Regarding claims 11 and 12, even if the limitations recited in these claims are for the sake of argument considered to be product-by-process limitations, the product of these claims is itself defined by the limitations of claim 1, the requirements of which are not taught or even suggested by the beams of Figs. 1A, 1B, 2A, and 2B.

Claims 1, 2, 4, 5-10, 13, 15, and 18 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,659,171 to Young et al., (Young). The Examiner pointed to Young Figs. 4A, 4B, and 5 as teaching a bistable MEMS structure. Figs. 4A-4B of Young illustrate a structure including a membrane 65

formed of two material layers, a bottom layer 67 and an upper layer 69. Fig. 4A shows the structure as-fabricated in an uncurved position, in direct contradiction to the requirement by the claims that a deflection element be provided in a curved position. Young explains that when an electrical current is passed through the upper membrane layer 69 the bilayer membrane bends upward away from the substrate 71 as shown in Fig. 4B (Col. 4, lines 5-15).

Young goes on to explain that if the upper layer 69 is an electrode layer separated from the substrate 71 by a dielectric layer 75 as in Fig. 5, then electrostatic clamping shut of the membrane with the substrate can be conducted, with the application of a voltage bias as shown in Fig. 5 (Col. 4, lines 16-29). In either configuration, the Young structure is provided, as-fabricated, in an initially uncurved, straight position, in contradiction to the requirement of the claims that the initial position of a deflection element be curved in one of two stable deflection positions.

Young's two deflection positions, shown upward in Fig. 4B and downward in Fig. 5, are not stable positions, in contrast to the requirement of the claims for stable deflection positions. Young makes clear that these are not stable positions, in explaining that the electrostatic clamping technique shown in Fig. 5 can be preferred because the ohmic heating technique required by the configuration of Fig. 4 can consume significant power. This is because Young requires that a continuous actuation force be provided "on" to maintain his membrane in the upwardly curved position of Fig. 4B or the downwardly curved position of Fig. 5. If Young's curved deflection positions were stable positions as required by the claims, no actuation force would be required to maintain the curved positions; once the positions were achieved, the actuation force could be turned "off" and the membrane would remain stable in the curved position.

Further, Young's membrane layers are clearly uniform in thickness across the entire extent of the membrane. There is no modulation of the membrane thickness as required by the claims. Therefore, like the prior art beams of Figs. 1-2 of the instant application, the structure of Young is found to fail to provide the requirements of the claims and neither teaches nor suggests the deflection element of the claims.

Claims 16 and 17 were rejected under 35 U.S.C. §103(a) as being obvious over the prior art beams of Figs. 1-2 of the instant application or Young, combined with U.S. Patent No. 6,239,685, to Albrecht et al. (Albrecht).

As explained above, neither the prior art beams of Figs. 1-2 of the instant application nor Young teach or suggest the deflection element of the invention. All fail to provide deflection element spans that are provided as-fabricated curved in one of two stable positions with a curve maxima at least about ¼ of the span length from end points of the span as required by the claims. All fail to provide a deflection element span that is modulated in thickness along the span.

Albrecht Fig. 3, referenced by the Examiner, illustrates a conceptual rendition of a bistable switch having a shorting bar 304 for contacting contact elements 305 (Col. 7, lines 58-65). The Albrecht switch is described as operating bistably, but does not provide a modulation in thickness along the length of the beam 301/302 of the switch.

No combination of the teaching of the prior art beams of Figs. 1-2 of the instant application or that of Young with the teaching of Albrecht provides the requirements of claim 1, let alone claims 16-17, which each depend from claim 1. For any electrical contact configuration, the requirements of claim 1 are not met by any combination of the three.

Claims 19 and 20 were rejected under 35 U.S.C. §103(a) as being obvious over the prior art beams of Figs. 1-2 of the instant application or Young, combined with U.S. Patent No. 5,619,177 to Johnson et al., (Johnson).

As explained above, neither the prior art beams of Figs. 1-2 of the instant application nor Young teach or suggest the deflection element of the invention. All fail to provide deflection element spans that are provided as-fabricated curved in one of two stable positions with a curve maxima at least about ¼ of the span length from end points of the span as required by the claims. All fail to provide a deflection element span that is modulated in thickness along the span.

Johnson Figs. 1A and 1B referenced by the Examiner illustrate a cantilever beam 12 secured at one end 14 to a substrate 16. The cantilever is normally "closed" against the substrate as shown in Fig. 1A (Col. 3, lines 52-56, Col. 4, lines 41-46). Application of an electrical potential can be employed to hold the cantilever against the substrate (Col. 4, lines 41-46). To force the beam upward, away from the substrate, the upper layer 24 of the beam can be resistively heated to actuate under shape memory actuation (SMA) (Col. 5, lines 24-33).

Like Young, and the prior art beams of Figs. 1-2 of the instant application, Johnson fails to teach or suggest the deflection element requirements of claim 1 and no combination of the three provide such. Johnson describes a cantilever structure which is provided with one end secured to the substrate and the other end free to deflect. But the claims require that the deflection element have mechanically constrained end points. Johnson's unconstrained cantilever fails to meet this requirement. Johnson's cantilever does not exhibit a curve as-fabricated, and the thickness of the cantilever is not modulated along the cantilever length. Thus, Johnson fails to provide the requirements of the claims missing in Young and the prior art beams of Figs. 1-2. For any actuation force

taught by Johnson, whether thermal, electrostatic, or otherwise, no combination of the three provide the deflection element requirements of claim 1, from which claims 19-20 depend.

The Applicants further note that no patent identified by the Examiner as part of the prior art of record teaches or suggests all of the requirements of claim 1 and the dependent claims, all depending from claim 1.

The Applicants therefore submit that the claims are in condition for allowance, which action is requested.

If the Examiner has any questions or would like to discuss the claims, he is encouraged to telephone the undersigned Agent directly at his convenience at the phone number given below.

An Information Disclosure Statement accompanies this response.

Respectfully submitted,

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